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EXAMINER	
MUMMERT, STEPHANIE KANE	
ART UNIT	PAPER NUMBER
1637	

NOTIFICATION DATE	DELIVERY MODE
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

pat-dept@quarles.com

Office Action Summary	Application No.	Applicant(s)	
	10/688,416	SCHWARTZ ET AL.	
	Examiner	Art Unit	
	STEPHANIE K. MUMMERT	1637	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *30 July 2009*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) _____ is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-18,20-31,33-40,42-49 and 51-70* is/are rejected.

7)☒ Claim(s) *19 and 41* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Applicant's amendment filed on July 30, 2009 is acknowledged and has been entered. Claims 1, 11-13, 25, 33-35, 48 and 51-53 have been amended. Claims 10, 32, 50 have been canceled. Claims 1-11, 12-31, 33-49 and 51-70 are pending. Claims 71-94 are withdrawn from consideration as being drawn to a non-elected invention.

Claims 1-31, 33-49 and 51-70 are discussed in this Office action.

This action is made FINAL.

Previous Grounds of Rejection

The rejection of claims 11-16, 33-38 and 51-56 under 35 USC 112, second paragraph is withdrawn in view of the amendment to the claims.

Priority

The later-filed application must be an application for a patent for an invention which is also disclosed in the prior application (the parent or original non-provisional application or provisional application). The disclosure of the invention in the parent application and in the later-filed application must be sufficient to comply with the requirements of the first paragraph of 35 U.S.C. 112. See *Transco Products, Inc. v. Performance Contracting, Inc.*, 38 F.3d 551, 32 USPQ2d 1077 (Fed. Cir. 1994).

The disclosure of the prior-filed application, Application No. 60/419,884 and the disclosure of the prior patents, 5,720,928, 6,294,136, and 6,610,256, fail to provide adequate

support or enablement in the manner provided by the first paragraph of 35 U.S.C. 112 for one or more claims of this application. Claims 10-16, 32-38 and 50-56 recite the claim limitation "periodically reversing the flow to cause the polymeric molecules to hover in an elongated/aligned or separated state". This claim limitation does not have support in the disclosures of the applications or patents to which priority is claimed. The claims are being granted the filing date of the instant application, October 17, 2003.

As claims 1, 25 and 48 have been amended to incorporate the limitations of claims 10, 32 and 50, each of the pending claims in this case are being granted the filing date of the instant application, October 17, 2003

The rejections below have been modified to replace "recited" for the term "disclosed", to stress that the limitations of the claims are being compared and not the disclosures of the issued patents. This did not appear to cause any confusion in prosecution.

Double Patenting

The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting

ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

1. Claim 1, 4-7, 17, 25, 28-31, 39, 45-47 and 48 are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claim 1 of U.S. Patent No. 7,049,074, issued May 23, 2006 ('074 patent herein) in view of Fuchs et al. (US PgPub 2005/0112606; May 5, 2005, 102(e) date April 10, 2003). Although the conflicting claims are not identical, they are not patentably distinct from each other.

Claim 1 of the '074 patent is directed to a method of elongating and fixing a nucleic acid molecule on a planar surface coated with a positively charged substance and the density of said positively charged substance is sufficient that nucleic acid molecule is fixed and elongated along its length on the planar surface. Claim 1, 25 and 48 of the instant application are drawn to a method of elongating, aligning or separating polymeric molecules comprising multiple steps, including placing the polymeric molecules in a carrier liquid, passing the molecules and liquid through a microchannel comprising a wall and controlling the elongation/alignment or separation of polymeric molecule through control of laminar flow and causing the molecule to adhere in a straightened configuration to the wall. Claims 4-7, 23-24, 29-31 and 45-47 of the instant application are directed to applying restricting enzymes or a second polymeric molecule to the straightened polymer and include steps of optical inspection of the polymer. The limitations recited in independent claims 1, 25 and 48 in combination with the absorption and elongation of the polymeric molecule of claim 17 and 39, and in view of the reactions of claims 4-7, 23-24, 29-31 and 45-47, are recited generally in the method of claim 1.

The differences between the claims arise because while the claims are not identical, both sets of claims comprise straightening polymeric molecules generically (or nucleic acids specifically in the '074 patent) through fixing the polymers through electrostatic attraction between the polymer and the surface, the '074 patent does not mention elongation using laminar flow. Furthermore, in the '074 patent, the surface is broadly claimed as planar and comprises a positively charged substance, while the instant application comprises a microchannel with a wall surface, specifically.

However, Fuchs teaches the elongation, alignment and fixation of polymeric molecules through laminar flow in microchannels, comprising planar surfaces with electrostatic forces (p. 1). Specifically, Fuchs teaches "the microfluidic devices of the present invention are adapted to orient and/or manipulate a polymer or group of polymers in various manners. These may include positioning, aligning, elongating one or more polymers, or retaining one or more polymers in an aligned or elongated state" (p. 1, paragraph 5). Fuchs also teaches "the microchannel is constructed and arranged to transport a polymer carrier fluid such that, when present, the polymer flows from the first end towards the second end in a laminar flow stream" (p. 1, paragraph 6). Regarding electrostatic forces, Fuchs teaches "some polymers, such as DNA or RNA, may contain an electrical charge that allows them to be manipulated by an electrical field" and "an electrical field may be useful in drawing portions of a polymer towards opposed sidewalls of the microchannel" (p. 8, paragraph 86). The channel of Fuchs is also sized to provide laminar flow having liquid flow lines all substantially parallel to each other along the full length of the micro-channel as depicted in multiple figures, including Figures 9-12.

Therefore, in view of the teaching of Fuchs, the claims of the instant application and the '074 patent address a similar scope and breadth of a method of fixing and straightening of polymers or nucleic acids such that the claims of the instant application are obvious over the claims of the '074 patent.

2. Claims 1, 3, 4-7, 17, 23-25, 27-31, 39, 45-48 are rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-2, 10, 12-13, 15-16, and 26-27 of U.S. Patent No. 6,509,158, issued January 2003 ('158 patent herein) in view of Fuchs et al. (US PgPub 2005/0112606; May 5, 2005, 102(e) date April 10, 2003). Although the conflicting claims are not identical, they are not patentably distinct from each other.

Claim 1 of the '158 patent is directed to a method of characterizing a nucleic acid molecule comprising imaging the nucleic acid molecule, which is elongated and fixed along its length on a solid planar surface so that said nucleic acid molecule is individually accessible to enzymatic reactions. Claim 1, 25 and 48 of the instant application are drawn to a method of elongating, aligning or separating polymeric molecules comprising multiple steps, including placing the polymeric molecules in a carrier liquid, passing the molecules and liquid through a microchannel comprising a wall and controlling the elongation/alignment or separation of polymeric molecule through control of laminar flow and causing the molecule to adhere in a straightened configuration to the wall. Claims 4-7, 23-24, 29-31 and 45-47 of the instant application are directed to applying restricting enzymes or a second polymeric molecule to the straightened polymer and include steps of optical inspection of the polymer.

While the claims are not identical, the differences between the instant claims and the '158 claims arise because while both the methods comprise embodiments of straightening polymeric molecules generically (or nucleic acids specifically in the '158 patent) through fixing the polymers through electrostatic attraction between the polymer and the surface, the '158 patent does not require elongation in laminar flowing liquid. Furthermore, In the '158 patent, the surface is broadly claimed as planar while the instant application comprises a microchannel with a wall surface, specifically.

However, Fuchs teaches the elongation, alignment and fixation of polymeric molecules through laminar flow in microchannels, comprising planar surfaces with electrostatic forces (p. 1). Specifically, Fuchs teaches "the microfluidic devices of the present invention are adapted to orient and/or manipulate a polymer or group of polymers in various manners. These may include positioning, aligning, elongating one or more polymers, or retaining one or more polymers in an aligned or elongated state" (p. 1, paragraph 5). Fuchs also teaches "the microchannel is constructed and arranged to transport a polymer carrier fluid such that, when present, the polymer flows from the first end towards the second end in a laminar flow stream" (p. 1, paragraph 6). Regarding electrostatic forces, Fuchs teaches "some polymers, such as DNA or RNA, may contain an electrical charge that allows them to be manipulated by an electrical field" and "an electrical field may be useful in drawing portions of a polymer towards opposed sidewalls of the microchannel" (p. 8, paragraph 86). The channel of Fuchs is also sized to provide laminar flow having liquid flow lines all substantially parallel to each other along the full length of the micro-channel as depicted in multiple figures, including Figures 9-12.

Therefore, considering that both sets of claims are directed to optical or imaging analysis of the straightened polymers and include enzymatic analysis and considering the teachings of Fuchs, the claims of the instant application and the '158 patent address a similar scope and breadth of a method of fixing and straightening of polymers or nucleic acids such that the claims of the instant application are obvious over the claims of the '158 patent.

The statement of rejection has been amended to correct a typographical error. The statutory basis correctly refers to rejection under 102(e), however the statement incorrectly states 102(a).

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1-3, 8-9, 11-12, 16-18, 25-27, 33-34, 38-40, 42, 48, 51-52, 56, 64 and 69 are rejected under 35 U.S.C. 102(e) as being anticipated by Fuchs et al. (US PgPub 2005/0112606; May 5, 2005, 102(e) date April 10, 2003). Fuchs teaches elongation, alignment and analysis of polymers in laminar flow in a microchannel format (Abstract).

With regard to claim 1, Fuchs teaches a method for elongating polymeric molecules comprising the steps of:

(a) passing a polymeric molecule in a laminar-flowing liquid through a micro-channel sized to

provide laminar flow of the liquid having liquid flow lines all substantially parallel to each other along a full length of the micro-channel length (p. 1 summary; p. 6, paragraph 69, where the term laminar flow is described; see p. 7, paragraph 79, where a polymer is elongated with laminar flow and causes alignment and straightening of the polymer; see Figures 9-12, for example, where the fluid flow lines are substantially parallel to each other); and

(b) controlling the flow of liquid to cause elongation of the polymeric molecule within the laminar flow (p. 1 summary; p. 6, paragraph 69, where the term laminar flow is described; see p. 7, paragraph 79, where a polymer is elongated with laminar flow and causes alignment and straightening of the polymer); and

(c) periodically reversing the laminar flow to cause the polymeric molecule to hover in an elongated state (p. 12, paragraph 105-106, where an elongated polymer is taught and "it may be desirable to hold it in that state for prolonged analysis steps" and that "the flow slows or stops leaving the polymer substantially still relative to the microchannel").

With regard to claim 25, Fuchs teaches a method for aligning polymeric molecules comprising the steps of: (a) passing a plurality of polymeric molecules in a laminar-flowing liquid through a micro-channel sized to provide laminar flow of the liquid having liquid flow lines all substantially parallel to each other along a full length of the micro-channel length (p. 1 summary; p. 6, paragraph 69, where the term laminar flow is described; see p. 7, paragraph 79, where a polymer is elongated with laminar flow and causes alignment and straightening of the polymer; see Figures 9-12, for example, where the fluid flow lines are substantially parallel to each other); and

(b) controlling the flow of liquid to cause alignment of the polymeric molecules within the laminar flow (p. 1 summary; p. 6, paragraph 69, where the term laminar flow is described; see p. 7, paragraph 79, where a polymer is elongated with laminar flow and causes alignment and straightening of the polymer); and

(c) periodically reversing the laminar flow to cause the polymeric molecule to hover in an elongated state (p. 12, paragraph 105-106, where an elongated polymer is taught and "it may be desirable to hold it in that state for prolonged analysis steps" and that "the flow slows or stops leaving the polymer substantially still relative to the microchannel").

With regards to claim 48, Fuchs teaches a method for separating polymeric molecules of differing molecular weight comprising the steps of:

(a) passing polymeric molecules in a laminar-flowing liquid through a micro-channel sized to provide laminar flow of the liquid liquid having liquid flow lines all substantially parallel to each other along a full length of the micro-channel length (p. 1 summary; p. 6, paragraph 69, where the term laminar flow is described; see p. 7, paragraph 79, where a polymer is elongated with laminar flow and causes alignment and straightening of the polymer); and

(b) controlling the laminar flow of liquid to separate the polymeric molecules of differing molecular weights within the laminar flow (p. 1 summary; p. 6, paragraph 69, where the term laminar flow is described; see p. 7, paragraph 79, where a polymer is elongated with laminar flow and causes alignment and straightening of the polymer; see Figures 9-12, for example, where the fluid flow lines are substantially parallel to each other); and

(c) periodically reversing the laminar flow to cause the polymeric molecule to hover in an elongated state (p. 12, paragraph 105-106, where an elongated polymer is taught and "it may be

desirable to hold it in that state for prolonged analysis steps" and that "the flow slows or stops leaving the polymer substantially still relative to the microchannel").

With regard to claim 2, 26, 69, Fuchs teaches an embodiment of claim 1, 25, 48, wherein the micro-channel has a cross-sectional dimension within one order of magnitude of a relaxed diameter of the polymeric molecule (p. 4, paragraph 57, where embodiments include microchannel cross sections of varying widths, including smaller dimensions to inhibit relaxation and larger diameters to accommodate polymers in coiled or relaxed state; see Figures 21 and 23).

With regard to claim 3, 27, 64, Fuchs teaches an embodiment of claim 1, 25, 48, wherein the micro-channel includes a transparent wall and including the step of optically analyzing the elongated polymeric molecule suspended within the laminar flow (p. 12, paragraph 105, where the polymer is elongated and analyzed which suspended within the flow; see also p. 4, where the details of optical detection are described).

With regard to claim 8, Fuchs teaches an embodiment of claim 1, wherein multiple polymeric molecules are simultaneously passed through the channel (p. 1, paragraph 5, where the device is adapted to "orient or manipulate a polymer or group of polymers").

With regard to claim 9, Fuchs teaches an embodiment of claim 1, including the step of staging the polymeric molecule with a plurality of other polymeric molecules in the liquid before passage through the channel (p. 1, paragraph 5, where the device is adapted to "orient or manipulate a polymer or group of polymers").

With regard to claim 11, 33, 51, Fuchs teaches an embodiment of claim 10, 32, 50, wherein the laminar flow is periodically reversed at a rate from between 0.2-5 Hz (p. 12, paragraph 105-106, where an elongated polymer is taught and "it may be desirable to hold it in

that state for prolonged analysis steps" and that "the flow slows or stops leaving the polymer substantially still relative to the microchannel").

With regard to claim 12, 34, 52, Fuchs teaches an embodiment of claim 10, 32, 50, wherein the micro-channel includes a transparent wall and including the step of optically analyzing the elongated polymeric molecule as it hovers within the laminar flow (p. 12, paragraph 105, where the polymer is elongated and analyzed which suspended within the flow; see also p. 4, where the details of optical detection are described).

With regard to claim 16, 38, 56, Fuchs teaches an embodiment of claim 15, 35, 55, wherein the polymeric molecules are DNA (p. 3, paragraph 45, where a variety of polymers are taught including nucleic acids, DNA and RNA).

With regard to claims 17 and 39, Fuchs teaches an embodiment of claim 1, 25, wherein at least a first wall of the micro-channel provides attraction to the polymeric molecule and further including the step of: (c) adsorbing of the polymeric molecule to the first wall of the micro-channel in straightened form (p. 7, paragraph 76 and 78, where the nucleic acid is anchored and straightened/aligned through the forces on the fixed polymer; see Figure 9, where the end (50) is fixed or adsorbed).

With regard to claim 18, 40, Fuchs teaches an embodiment of claim 17, 39 wherein step (c) includes the steps of controlling the flow rate of the liquid and the size of the micro-channel to cause adsorption by random encounters between at least one end of the polymeric molecule and a wall of the micro-channel (p. 11, paragraph 103-104, where transient tethering occurs through random contact with the wall of the microchannel).

With regard to claim 20, 42, Fuchs teaches an embodiment of claim 17, 39, wherein step (c) includes the step of applying an electrostatic field across the width of the micro-channel to cause adsorption of the polymeric molecule to one wall of the micro-channel (p. 8, paragraph 86, where an electrostatic field is applied across the width of the microchannel "useful in drawing portions of a polymer toward opposed sidewalls of the microchannel").

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 4-7, 13-15, 23-24, 28-31, 35-37, 45-47, 49, 53-55, 57, 60-61, 63, 65-68 and 70 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fuchs et al. (US PgPub 2005/0112606; May 5, 2005, 102(e) date April 10, 2003) as applied to claims 1-3, 8-9, 11-12,

16-18, 25-27, 33-34, 38-40, 42, 48, 51-52, 56, 64 and 69 above and further in view of Chan et al. (US Patent 6,762,059; July 2004, 102(e) date, August 13, 1999).

With regard to claim 7, 31, 63, Fuchs teaches an embodiment of claim 6, 25, 57, wherein the polymeric molecules are DNA (p. 3, paragraph 45, where a variety of polymers are taught including nucleic acids, DNA and RNA).

With regards to claim 57, Fuchs teaches an embodiment of claim 49 further including the step of fixing the separated polymeric molecules to a substrate after their separation (p. 7, paragraph 76 and 78, where the nucleic acid is anchored and straightened/aligned through the forces on the fixed polymer; see Figure 9, where the end (50) is fixed or adsorbed).

With regards to claim 66, Fuchs teaches an embodiment of claim 65 further including the step of fixing the elongated polymeric molecules to a substrate (p. 7, paragraph 76 and 78, where the nucleic acid is anchored and straightened/aligned through the forces on the fixed polymer; see Figure 9, where the end (50) is fixed or adsorbed).

Regarding claims 7, 31, 57, 63, while Fuchs teaches the elongation of polymers, including DNA in laminar flowing liquid, Fuchs does not teach reacting the polymers with a reactant. Chan teaches characterization of polymers through elongation in microchannels.

With regard to claim 4, 13, 28, 35, 53, Chan teaches an embodiment of claim 1, 10, 25, 32, 50, including the step of reacting the elongated polymeric molecule suspended within the laminar flow with a reactant (col. 25, lines 23-30, where the polymers can be reacted with any sequence specific markers such as DNA or PNAs or intercalators).

With regard to claim 5, 14, 24, 29, 36, 46, 54, 61, Chan teaches an embodiment of claim 4, 13, 23, 28, 35, 45, 53, 60, wherein the reactant is an enzyme causing cleavage of the polymeric

molecule (col. 26, "5.4.1", where restriction enzymes can be used to label or cleave the polymeric molecule).

With regard to claim 6, 15, 30, 37, 55, 62, Chan teaches an embodiment of claim 4, 13, 28, 35, 53, 60, wherein the-reactant is a second polymeric molecule (col. 25, lines 23-30, where the polymers can be reacted with any sequence specific markers such as DNA or PNAs or intercalators).

With regard to claim 23, 45, 60, Chan teaches an embodiment of claim 17, 39, 57, further including the step of reacting the adsorbed polymeric molecule with a reactant (col. 25, lines 23-30, where the polymers can be reacted with any sequence specific markers such as DNA or PNAs or intercalators).

With regards to claim 49, Chan teaches an embodiment of claim 48 further including the step of controlling the flow of liquid to elongate the molecules and separate the elongated molecules by their relative speeds within the laminar flow (col. 17-18, where the elongated molecules are analyzed with regard to their relative speed or 'center of mass' velocity within the flow of the apparatus of the invention; see col. 15, lines 41-52, where the invention provides structures for the stretching and elongation of polymers).

With regards to claim 65, Chan teaches an embodiment of claim 48 further including the step of controlling the flow of liquid to cause elongation only of the polymeric molecules of a predetermined molecular weight range within the laminar flow (col. 38, lines 10-21, where the size of molecules of interest range from several kilobases to at least a megabase of DNA).

With regards to claim 67, Chan teaches an embodiment of claim 65 further including the step of controlling the flow of liquid to separate the elongated and unelongated molecules as a

function of their differing speed within the laminar flow and to separate the elongated molecules from the unelongated molecules by their different speeds in the laminar flow (col,. 37, Figure 23, where polymers of a particular length remain elongated, while polymers of a different length recoil and are no longer elongated and these molecules traverse different and separate paths in the substrate).

With regards to claim 68, Chan teaches an embodiment of claim 65 further including the step of obtaining a digital image of the elongated and unelongated molecules and separating them by image processing (col. 45, lines 10-39, Example 1, where digital images were obtained and both elongated and unelongated molecules were analyzed).

With regards to claim 70, Chan teaches an embodiment of claim 48 further including the step of controlling the flow of liquid to separate the molecules as a function of their propensity to be adsorbed as a function of their length while moving in the laminar flow (col,. 37, Figure 23, where polymers of a particular length remain elongated, while polymers of a different length recoil and are no longer elongated and these molecules traverse different and separate paths in the substrate).

While Chan and Fuchs teach the elements of labeling the polymer or treating the polymer with an enzyme, the labeling or treatment is applied before the polymer is elongated. However, it would have been prima facie obvious to one of ordinary skill in the art at the time the invention was made to modify the order of method steps taught by Chan to arrive at the claimed invention with a reasonable expectation of success. As noted in the MPEP § 2144.04 IV C, "Ex parte Rubin , 128 USPQ 440 (Bd. App. 1959) (Prior art reference disclosing a process of making a laminated sheet wherein a base sheet is first coated with a metallic film and thereafter

impregnated with a thermosetting material was held to render prima facie obvious claims directed to a process of making a laminated sheet by reversing the order of the prior art process steps.). See also In re Burhans, 154 F.2d 690, 69 USPQ 330 (CCPA 1946) (selection of any order of performing process steps is prima facie obvious in the absence of new or unexpected results); In re Gibson, 39 F.2d 975, 5 USPQ 230 (CCPA 1930) (Selection of any order of mixing ingredients is prima facie obvious.)." Therefore, in the absence of new or unexpected results, it would have been prima facie obvious to one of ordinary skill in the art to adjust the order of the method steps taught by Chan in view of Fuchs to arrive at the claimed invention with a reasonable expectation for success.

Furthermore, it would have been *prima facie* obvious to one of ordinary skill in the art at the time the invention was made to have extended the teachings of Fuchs to incorporate the additional methods of polymer stretching and elongation of Chan to arrive at the claimed invention with a reasonable expectation for success. Fuchs discloses methods that are directed to the separation, elongation and analysis of polymers as they pass through a microchannel passageway, as controlled by laminar flow. As taught by Chan, "the present invention also provides methods and structures that allow polymers of any length, including nucleic acids containing entire genomes, to be stretched or elongated for further analysis, e.g., determination of their velocities and lengths. Polymers are loaded into a device and run through the structures, propelled by, inter alia, physical, electrical or chemical forces" (col. 15, lines 41-52). These teachings generally address the issue of control of the flow and the speed of the molecules. Chan also states that their method addresses "a need for more accurate methods for determining the length of single elongated polymers and/or determining the length of single elongated polymers

and/or distances between landmarks on single elongated polymers". Therefore, while both Chan and Fuchs teach methods directed to the characterization of polymers, specifically DNA, Chan addresses the method from a different perspective than Fuchs, specifically aimed at the analysis of single molecules relative to their length and their velocity. Considering the combined teachings of these references, one of ordinary skill in the art at the time the invention was made would have been motivated to apply the techniques of analyzing and separating elongated polymers based on their velocities within the laminar flow as taught by Chan with a reasonable expectation for success.

4. Claims 21-22, 43-44 and 58-59 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fuchs in view of Chan as applied to claims 4-7, 13-15, 23-24, 28-31, 35-37, 45-47, 49, 53-55, 57, 60-61, 63, 65-68 and 70 above and further in view of Bensimon et al. (US Patent 6,256,153; July 2001).

Fuchs in view of Chan teach all of the limitations of claims 4-7, 13-15, 23-24, 28-31, 35-37, 45-47, 49, 53-55, 57, 60-61, 63, 65-68 and 70 as recited above. However, neither reference teaches a portion of the channel that is releasable.

With regard to claim 21, 43, 58, Bensimon teaches an embodiment of claim 17, 39, 57 wherein the micro-channel includes an elastic channel material releasably adhered to an optical mapping surface to create the micro-channel between the elastic material and the optical mapping surface and wherein the adsorption is to the optical mapping surface (Example 3, col. 19, lines 21-26, where the coverslip is removed from the adhered molecules).

With regard to claim 22, 44, 59, Bensimon teaches an embodiment of claim 21, 43, 58, further including the step of separating the elastic channel material from the optical mapping surface after adsorption of the polymeric molecule to the optical mapping surface (Example 3, col. 19, lines 21-26, where the coverslip is removed from the adhered molecules).

It would have been *prima facie* obvious to one of ordinary skill in the art at the time the invention was made to have applied the teachings of Bensimon to the method of DNA stretching and analysis taught by Fuchs to arrive at the claimed invention with a reasonable expectation for success. Fuchs teaches a method comprising affixing one end of a DNA molecule to a wall and stretches the DNA using fluid flow, or laminar flow. Bensimon teaches a very similar method of DNA analysis, however in this case an end of the DNA is fixed and the DNA is aligned along the length of a wall (col. 3, lines 11-17, where the support of Bensimon can take many forms, including beads or particles), through progress of a meniscus instead of by laminar flow. Therefore, as each of these elements were known in the prior art at the time of the invention and the combination of these elements would provide a predictable result, it would have been prima facie obvious to one of ordinary skill in the art at the time the invention was made to have incorporated these elements to analyze straightened DNA molecules.

Response to Arguments

Applicant's arguments filed July 30, 2009 have been fully considered but they are not persuasive.

First, in response to Applicant's inquiry about claims 19 and 41, it is noted that the reference to claims 19 and 41 as being free of the art, but not indicated as allowable has been

corrected to indicate that the claims are free of the art along with the reasoning. Claims 19 and 41 are allowable.

Next, it is noted that Applicant states that claim 20 was not rejected in the prior office action (see p. 15 of remarks). However, as noted on page 13 of the prior office action, mailed January 30, 2009, claim 20, along with 42 were rejected in view of Fuchs.

Applicant traverses the rejection of claims as being rejected under obviousness-type double patenting. Applicant summarizes the claims in Schwartz I and II. Regarding Fuchs, Applicant states "Fuchs teaches methods for positioning and elongating polymers in microchannels" and that Fuchs "neither teaches laminar flow, nor the periodic reversal of laminar flow through microchannels as recited by the claims" (p. 15-16 of remarks). Applicant concludes that Schwartz does not teach hovering of polymeric molecules in an elongated state and emphasizes that the molecule is fixed on a planar surface, not hovering.

These arguments have been considered but are not persuasive. Applicant argues that Fuchs does not teach laminar flow. However, this amounts to a mere allegation that Fuchs does not teach laminar flow, because no basis for this conclusion is provided.

Next, it is noted that while Applicant's arguments regarding fixation to a planar surface in copending claims in Schwartz have been considered, it is reiterated, as explicitly stated in the obviousness-type double patenting rejection, "The limitations recited in independent claims 1, 25 and 48 in combination with the absorption and elongation of the polymeric molecule of claim 17 and 39, and in view of the reactions of claims 4-7, 23-24, 29-31 and 45-47, are recited generally in the method of claim 1." The limitation of instant claim 1, taken together with instant claim

17, for instance, teaches a method where the polymer is hovering prior to elongation and fixation to the wall, or other planar surface. Therefore, the instant claims are obvious in view of the claims of Schwartz I and/or II in view of Fuchs, for the reasons stated in the obviousness-type double patenting rejection.

Next, Applicant traverses the rejection of claims as being anticipated by Fuchs. Applicant argues "the described 'slowing' or 'stopping' of the flow is not equivalent to reversing the flow" and notes "paragraphs [105] and [106], cited by the Examiner, teach a solution distinct from laminar flow hovering for holding the polymer in an elongated state" and points to the "crimp" discussed in Fuchs (p. 16 of remarks). Applicant also notes that certain figures of Fuchs "alter the path of the carrier fluid flow lines" and "in some instances even separating the flow lines altogether… such that the flow lines are no longer parallel" (p. 16 of remarks).

These arguments have been considered, but are not persuasive. It appears that Applicant is arguing that because a different structure is employed by Fuchs that indicates a teaching away from reversing the laminar flow to achieve an elongated polymer that "hovers". A careful reading of Applicant's independent claim 1, for example, finds no limitations which excludes a channel that has crimps, additional structures, or other features which control or direct the laminar flow of fluid or liquid. In the absence of such structural limitations, the teaching by Fuchs of laminar flow, elongation of polymeric molecules, and achieving hovering of elongated molecules anticipates the claim for the reasons stated in the art rejection above.

It is also noted the statement in Fuchs "The flow then slows or stops leaving the polymer substantially still relative to the microchannel" (see paragraph 106) fully meets the limitation of

"reversing the laminar flow" and "hover". A flow that moves forward is "reversed" if it comes to a stop. The claim merely requires that the flow is changed, not that the flow must move specifically in reverse. Therefore, the teaching by Fuchs, regardless of the manner in which the change in flow is achieved, anticipates the claims for the reasons stated above and the rejection is maintained.

Applicant traverses the rejection of claims as being obvious over Fuchs in view of Chan and the rejection of claims as being obvious over Fuchs, Chan and Bensimon. Applicant argues that Fuchs does not anticipate the claims for the reasons stated above and that "Chan does not bridge the gap between Fuchs and the claimed invention" and that "Chan does not teach periodically reversing the laminar flow..." (p. 17 of remarks). A similar argument is offered over Bensimon, stating "Bensimon does not overcome the shortcomings of Fuchs and Chan" (p. 17 of remarks).

These arguments are not persuasive for the same reasons as asserted above regarding Fuchs. The rejections are maintained.

Conclusion

No claims are allowed.

Claims 19 and 41 are free of the prior art. The closest prior art, Fuchs does not teach the application of an acceleration across the width of the microchannel. While the prior art teaches the inclusion of centrifugal acceleration for control of fluid flow, it would not have been obvious to one of ordinary skill to apply centrifugal forces to control the laminar flow of liquids in

combination with the teachings of Fuchs and the references which teach centrifugal control of fluid flow teach away from absorption of the molecules to the walls of the channel.

Claims 19 and 41 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claims 1-18,20-31,33-40,42-49 and 51-70 stand rejected.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Stephanie K. Mummert, Ph.D. whose telephone number is 571-272-8503. The examiner can normally be reached on M-F, 9:00-5:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Gary Benzion can be reached on 571-272-0782. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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